**Printed Pages: 03** **Subject Code: NME501**

**Paper Id: 140518** **Roll No:** | | | | | | | | | | |

**B TECH**
**(SEM V) THEORY EXAMINATION 2018-19**
**MACHINE DESIGN -I**

***Time: 3 Hours*** ***Total Marks: 100***

**Note: 1.**Attempt all Sections. If require any missing data; then choose suitably.
**2.** Standard design data book is allowed.

## Section-A

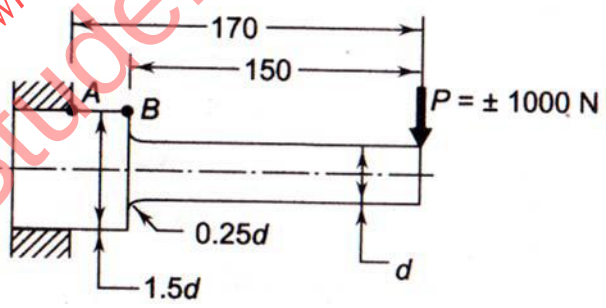
**1. Attempt all parts. All parts carry equal marks.** **(2x10 = 20)**

a) What is Factor of Safety for ductile and brittle material?
b) What are the factors affecting endurance strength?
c) What do you understand by notch sensitivity?
d) Write a short note on Modified Goodman Diagram.
e) Under what circumstances flexible couplings are used?
f) Write the numbers of active coils in terms of total number of coils for different end connections of compression springs.
g) What is Wahl correction factor and why is it needed in design of spring?
h) What is a self locking of power screw? What is the condition for self locking?
i) Explain different types of stresses are induced in shaft.
j) What are splines? What is the difference between splines and keys?

## Section B

**2. Attempt any five parts from this section.** **(5 X 10 = 50)**

(a) A cantilever beam made of cold drawn steel 20C8 ($S_{ut}$ =540 N/mm$^2$) is subjected to a completely reversed load of 1000 N as shown in below figure. The corrected endurance limit for the material of the beam may be taken as 123.8 N/mm$^2$. Determine the diameter "d" of the beam for a life of 10000 cycles.




(b) It is required to design square key for fixing a gear to transmit a torque of 198943.68 N-mm. The key is made of plain carbon steel having the yield point in tension and in compression as 460 MPa and factor of safety 3. Determine the dimensions of the key.

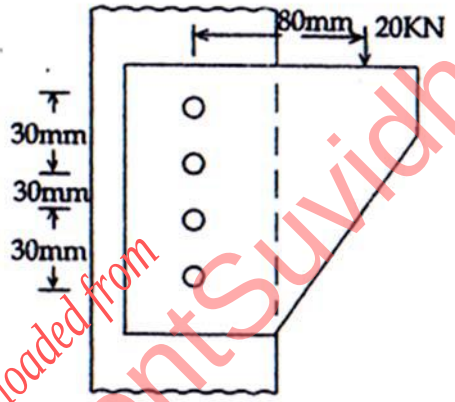
(c ) Name the various components of the screw jack and their usual materials. A single start square threaded screw of mean diameter 24 mm and pitch of 5mm is tightening by screwing a nut whose mean diameter at bearing surface is 50 mm. If the coefficient of friction between the nut and screw is 0.1 and for the nut and bearing surface is 0.16. Find the force required at the end of a spanner 0.5 meter long when the load on the screw is 10 kN.

(d) It is required to standardize load carrying capacities of dumpers in a manufacturing unit. The maximum and minimum capacities of such dumpers are 630 and 40 kN respectively. The company is interested in developing seven models in this range. Specify their load carrying capacities.

(e) (i) Explain maximum shear stress theory in detail.
(ii) Explain morphology of design in detail.

(f) Design a rigid flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below:
Shear stress on shaft =100 MPa
Bearing or crushing stress on shaft =250 MPa
Shear stress on keys =100 MPa
Bearing stress on keys =250 MPa
Shearing stress on cast iron =200 MPa
Shear stress on bolts =100 MPa

(g) A bracket supported by means of four rivets of the same size as shown in below figure. Determine the diameter of the rivets if the maximum permissible shear stress for the material of the rivet is as 150 N/mm$^2$.






(h) A helical tension spring is to be designed to withstand a maximum load of 1500 N. The material of the spring has ultimate tensile strength 1360 N/mm$^2$ and modulus of rigidity of 81370 N/mm$^2$. Assume perniissible sheai stress for the spring wire to be 50 percent of the ultimate tensile strength. The spring index can be taken as 6. Determine
(i) Wire diameter
(ii) Mean coil diameter
(iii) Number of active coils
(iv) Actual spring rate

## SECTION C

**Note: Attempt any two questions from this section.** **(15 X 2= 30)**

3. A mild steel shaft transmits 20 kW at 200 rpm. It is subjected to a bending moment of 562.5 N-m. Determine the size of the shaft, if the allowable shear stress is 42 MPa, and the maximum tensile or compressive stress is not to exceed 58 MPa. What size of the shaft will be required if it is subjected to gradually applied load.

4. (i) Describe the various forms of the threads used for power screw, giving their merits and demerits. (ii) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are:

$\sigma t = 120$ MPa; $\tau = 100$ MPa; $\sigma c = 150$ MPa
Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear.

5. (i) Explain the stress concentration effect and the various methods used to reduce this effect.

(ii)Draw and discuss briefly the S-N diagram.

(iii)What do you understand by the efficiency of the riveted joint and also discuss the significance of the caulking and fullering operation for the riveted joints?